UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/045,951	01/11/2002	Yaron I. Gold	6284 USA/PDC/CD-SEM/OR	2709

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APPLIED MATERIALS, INC.
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EXAMINER
CASCHERA, ANTONIO A

ART UNIT	PAPER NUMBER
2676	

DATE MAILED: 05/27/2004   *10*

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/045,951	GOLD, YARON I.
	Examiner	**Art Unit**
	Antonio A Caschera	2676

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 May 2004*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is

    closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-40* is/are pending in the application.

    4a) Of the above claim(s) *6,10,11,27,29-32 and 37-39* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-9,12-26,28,33-36 and 40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

    1.☐ Certified copies of the priority documents have been received.

    2.☐ Certified copies of the priority documents have been received in Application No. _____.

    3.☐ Copies of the certified copies of the priority documents have been received in this National Stage

        application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
   Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1.   Claims 4 and 12 are objected to because of the following informalities:

a.   The phrase, "Cannary filter" should be replaced with, "Canny filter" in order to

comply with the specification (see claim 4, line 2, and page 8, of applicant's

specification). Note, the office believes such informality to be a typo and therefore does

not apply a 35 U.S.C 112 2nd paragraph, rejection to the claim as originally filed claim 4

correctly discloses a, "canny filter."

b.   The phrase, "fo" should be replaced with the word, "of" in claim 12 (see line 2, of

claim 12).

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2.   Claims 1-5, 7-9, 12-26, 28, 33-36 and 40 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Park et al. (U.S. Patent 6,535,632 B1), He et al. (U.S. Patent 6,600,517 B1)

and further in view of Acharya et al. (U.S. Patent 6,094,508).

In reference to claims 1, 26 and 40, Park et al. discloses image processing applied to an

image frame to reduce and more uniformly distribute image noise (see lines 1-3 of abstract).

Park et al. discloses receiving an input image frame, disclosed as an array of image pixels (see

column 9, lines 48-54) which the office interprets as equivalent to receiving a matrix of pixels.

Park et al. also discloses generating a color gradient image comprising of matrix values

representative of a difference between values of adjacent pixels (see column 9, lines 4-8, 27-37

and Figures 8a-c). Park et al. does not explicitly disclose calculating a center of mass for each

pixel of the gradient image however He et al. does. He et al. discloses a system and method for

sharpening edges of video images (see lines 1-2 of abstract). He et al. discloses a second circuit

capable of determining a position of a first subpixel disposed between the first and second pixels

wherein the first subpixel position is disposed approximately at a center of the edge (see column

2, lines 41-44). He et al. also discloses utilizing luminance and subpixel position values in the

above second circuit (see column 2, lines 55-59). Note the office interprets the above pixel

determination functionally equivalent to subsection (c) of applicant's claim 1. He et al. discloses

modifying intensity values of second and third subpixels which are disposed on opposite sides of

an edge (center of mass pixel) (see column 2, lines 45-49). He et al. also further discloses a

second embodiment calling for the replacement of pixels close to the edge center with pixels

farther away from the edge center (see column 5, lines 30-31). It would have been obvious to

one of ordinary skill in the art at the time the invention was made to implement the image

processing methods of Park et al. with the system and methods of edge enhancement of He et al.

in order to provide an improved system and method for enhancing edges of video images without

introducing additional artifacts (see column 2, lines 24-30 of He et al.). Neither Park et al. nor

He et al. explicitly disclose pixels neighboring a pixel of the gradient image to comprise within a

neighborhood pattern however Acharya et al. does. Acharya et al. discloses a method for

gradient-based edge detection (see title and lines 1-3 of abstract) whereby neighboring pixels of a

gradient image are determined in a pattern by applying a mask (see column 7, lines 54-61 and

Figures 4a-b). Acharya et al. further discloses obtaining the gradient of each pixel by

considering the neighborhood pattern consisting of a mask covering a 3x3 area of surround

pixels (see column 9, lines 30-37). The office interprets that since Acharya et al. utilizes a

defined "mask area" of 3x3 pixels to calculate the gradient of a selected pixel, the local center of

mass, or the center pixel value, therefore Acharya et al. inherently takes into account pixels of a

distance between the pixel in question and the boundary of the "mask area." In other words, the

3x3 "mask area" of Acharya et al. is a fixed area which considers only those pixels surrounding

the center pixel and therefore disregards other neighboring pixels which exceed the length of the

3x3 "mask area" (see Figures 4a and 4b of Acharya et al.). With this logic, the office interprets

Acharya et al. to inherently disclose a pixel being located in the vicinity of a local center of mass

if a distance between the pixel and at least a portion of the local center of mass does not exceed a

length of the neighborhood pattern. It would have been obvious to one of ordinary skill in the art

at the time the invention was made to implement the image processing methods of Park et al. and

the system/methods of edge enhancement of He et al. with the pixel gradient computational

methods of Acharya et al. in order to better detect edge features allowing for the further removal

of blurriness and enhancement of edges as edges that cannot be detected, cannot be enhanced

(see column 1, lines 31-39 and 42-45 of Acharya et al.).

In reference to claims 2 and 28, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claims 1 and 26 respectively in addition, Park et al. discloses smoothing the image before generating a gradient image by applying smoothing filters to the input image (see column 7, lines 51-58, column 8, lines 51-52 and #24, 28, 30 of Figure 2).

In reference to claim 3, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 2 above in addition, Park et al. discloses smoothing the image to decrease noise resulting from intensity and saturation levels (see column 7, lines 33-58).

In reference to claim 4, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 2 above in addition, Park et al. discloses generating the color gradient image convolving a Gaussian operator with a pixel component (see column 9, lines 6-26). Note although Park et al. does not explicitly use the terminology, "Canny filter," the disclosure above of Park et al. is seen by the office as functionally equivalent to the description of a, "Canny filter" found on page 8 of applicant's specification.

In reference to claim 5, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 2 above in addition, Park et al. discloses applying a kernel operation on the pixels when smoothing the image (see columns 7-8, lines 51-62).

In reference to claim 7, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 1 above in addition, Acharya et al. discloses the neighborhood pattern being symmetric around a pixel (see Figures 4a-b, symmetric around pixel I4).

In reference to claim 8, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 1 above. Neither Park et al., He et al. nor Acharya et al. explicitly disclose the neighborhood pattern being asymmetric around a pixel however, at the time the

invention was made, it would have been obvious to one of ordinary skill in the art to modify the

neighborhood determining mask of Acharya et al. to apply an asymmetric pattern around a pixel.

Applicant has not disclosed that an asymmetric pattern provides an advantage, is used for a

particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore,

would have expected Applicant's invention to perform equally well with a symmetric pattern

because a symmetric pattern gives a good estimation of the relative strength of a center pixel

against its neighbors (see column 7, lines 65-67 of Acharya et al.). Therefore, it would have

been obvious to one of ordinary skill in this art to modify Acharya et al. to obtain the invention

as specified in claim 8.

In reference to claim 9, Park et al., He et al. and Acharya et al. disclose all of the claim

limitations as applied to claim 1 above. Neither Park et al., He et al. nor Acharya et al. explicitly

disclose the neighborhood pattern being selected from a list consisting of a cross, a diamond, a

rectangle and an octagonal region however, at the time the invention was made, it would have

been obvious to one of ordinary skill in the art to modify the neighborhood determining mask to

apply one of the above patterns around a pixel. Applicant has not disclosed that one of the above

patterns provides an advantage, is used for a particular purpose, or solves a stated problem. One

of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform

equally well with a symmetric pattern because a symmetric pattern gives a good estimation of

the relative strength of a center pixel against its neighbors (see column 7, lines 65-67 of Acharya

et al.). Therefore, it would have been obvious to one of ordinary skill in this art to modify

Acharya et al. to obtain the invention as specified in claim 9.

In reference to claim 12, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 1 above. He et al. discloses a second circuit capable of determining a position of a first subpixel disposed between the first and second pixels wherein the first subpixel position is disposed approximately at a center of the edge (see column 2, lines 41-44). Since the neighborhood pattern is not clearly defined in the claims, the office interprets that the first subpixel of He et al., located at a center of an edge, could be disposed in a neighborhood pattern. Further, due to lack of clarity, the neighborhood pattern could be interpreted as the subpixel disposed a certain amount between first and second edge pixels.

In reference to claims 13 and 33, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claims 1 and 26 respectively in addition, Acharya et al. discloses changing the mask pattern to compensate for the two dimensions vertical and horizontal (see column 8, lines 37-45 and Figure 4b). Neither Park et al., He et al. nor Acharya et al. explicitly disclose performing the changing of the pattern followed by step (c) of claim 1 and prior to step (b) of claim 26 however it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the neighborhood pattern prior to calculating the center of mass of a pixel allowing for the new pattern to directly effect intensity values used in the calculations to compute center of mass and detect edges.

In reference to claim 14, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 13 above. Neither Park et al., He et al. nor Acharya et al. explicitly disclose changing the size of the neighborhood pattern however it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the size

of the neighborhood pattern when processing images of higher resolution as higher resolution

images may require the measuring of a greater number of surrounding pixels.

In reference to claims 15 and 34, Park et al., He et al. and Acharya et al. disclose all of

the claim limitations as applied to claims 1 and 26 above in addition, Acharya et al. discloses

normalizing the gradient values of pixels in a neighboring region by dividing the already

calculated gradient for a center pixel (computed by summing the results of a magnification

between intensity value and location of the neighbor pixels) by the maximum gradient of all

pixels within the local region (see column 8, lines 4-10, 50-56 and column 9, lines 20-51). Note

the office interprets the above process as functionally equivalent to calculating the center of mass

of a pixel.

In reference to claim 16, Park et al., He et al. and Acharya et al. disclose all of the claim

limitations as applied to claim 14 above in addition, He et al. discloses the selecting of a pixel

responsive to the displacement of the center of mass and the pixel located in the vicinity of the

center of mass (see column 5, lines 51-59 and Figure 2). The office interprets the line #215 of

Figure 2 to represent the center of mass and pixels on both sides of #215 being moved toward

#215 according to displacement from #215.

In reference to claim 17, Park et al., He et al. and Acharya et al. disclose all of the claim

limitations as applied to claim 1 above. He et al. discloses a second circuit capable of

determining a position of a first subpixel disposed between the first and second pixels wherein

the first subpixel position is disposed approximately at a center of the edge (see column 2, lines

41-44). The office interprets the first and second pixels to be positioned on opposite sides of the

edge since the first subpixel is found at the center of the edge and between the first and second

pixels thus the first and second pixels reflect the width of an edge.

In reference to claim 18, Park et al., He et al. and Acharya et al. disclose all of the claim

limitations as applied to claim 16 above. Neither Park et al., He et al. nor Acharya et al.

explicitly disclose limiting modification of pixel values that are located in a vicinity of small

objects however, it is well known in the image processing art for smaller objects to comprise of a

lesser number of pixels when compared to larger objects (Official Notice). It would have been

obvious to one of ordinary skill in the art for He et al., to limit the modifying of pixels located in

the vicinity of smaller objects of images because it is well known in the art of image processing

that smaller sized objects are made up of a smaller number of pixels thus making modifications

to pixels in the objects more prone to visual artifacts, such as poor image smoothing and radical

contrast changes, because they're a smaller number of pixels to begin with.

In reference to claim 19, Park et al., He et al. and Acharya et al. disclose all of the claim

limitations as applied to claim 16 above. Neither Park et al., He et al. nor Acharya et al.

explicitly disclose preventing modification of pixel values that are located in a vicinity of small

objects however, it is well known in the image processing art for smaller objects to comprise of a

lesser number of pixels when compared to larger objects (Official Notice). It would have been

obvious to one of ordinary skill in the art for He et al., to prevent the modifying of pixels located

in the vicinity of smaller objects of images because it is well known in the art of image

processing that smaller sized objects are made up of a smaller number of pixels thus making

modifications to pixels in the objects more prone to visual artifacts, such as poor image

smoothing and radical contrast changes, because they're a smaller number of pixels to begin with.

In reference to claims 20, 21 and 35, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claims 1 and 26 above. He et al. discloses a second embodiment calling for the replacement of pixels close to the edge center with pixels farther away from the edge center (see column 5, lines 30-31).

In reference to claim 22, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 21 above in addition, He et al. discloses the selecting of a pixel responsive to the displacement of the center of mass and the pixel located in the vicinity of the center of mass (see column 5, lines 51-59 and Figure 2). The office interprets the line #215 of Figure 2 to represent the center of mass and pixels on both sides of #215 being moved toward #215 according to displacement from #215.

In reference to claim 23, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 22 above in addition, He et al. discloses calculating gain factors based on whether the pixels are adjacent to edges and/or their displacement from an edge (see column 8, lines 26-56). The office interprets the gain factors to be equivalent to the weight factor of claim 23.

In reference to claim 24, Park et al., He et al. and Acharya et al. disclose all of the claim limitations as applied to claim 23 above. Neither Park et al. nor He et al. explicitly disclose the weight factors responsive to the size of an object however it would have been obvious to one of ordinary skill in the art at the time the invention was made to create weight factors responsive to

the size of an object in order to compensate for different displacements from pixels to the center

of mass of objects as it is well known in the art that not all edges (objects) are of the same size.

In reference to claims 25 and 36, Park et al., He et al. and Acharya et al. disclose all of

the claim limitations as applied to claims 1 and 26 respectively. Although Park et al. discloses a

camera to capture a sensor image of an object or scene (see column 9, lines 54-60 and #530 of

Figure 5), neither Park et al. nor He et al. explicitly disclose the use of a scanning electron

microscope to generate the image. At the time the invention was made, it would have been

obvious to one of ordinary skill in the art to modify Park et al. by implementing a scanning

electron microscope, instead of a camera, to generate the input image. Applicant has not

disclosed that utilizing a scanning electron microscope provides an advantage, is used for a

particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore,

would have expected Applicant's invention to perform equally well with the camera of Park et

al. because both devices supply image data in the form of pixel data. Therefore, it would have

been obvious to one of ordinary skill in this art to modify Park et al. to obtain the invention as

specified in claims 25 and 36.

Response to Arguments

3.   In view of the Amendment B filed on 5/10/2004, PROSECUTION IS HEREBY

REOPENED. A new grounds of rejection is set forth above.

4.   Applicant's arguments with respect to claims 1-5, 7-9, 12-26, 28, 33-36 and 40 have been

considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Antonio Caschera whose telephone number is (703) 305-1391.

The examiner can normally be reached Monday-Thursday and alternate Fridays between 7:00

AM and 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Matthew Bella, can be reached at (703)-308-6829.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive,

Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding

should be directed to the Technology Center 2600 Customer Service Office whose telephone

number is (703) 306-0377.

MATTHEW C. BELLA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

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